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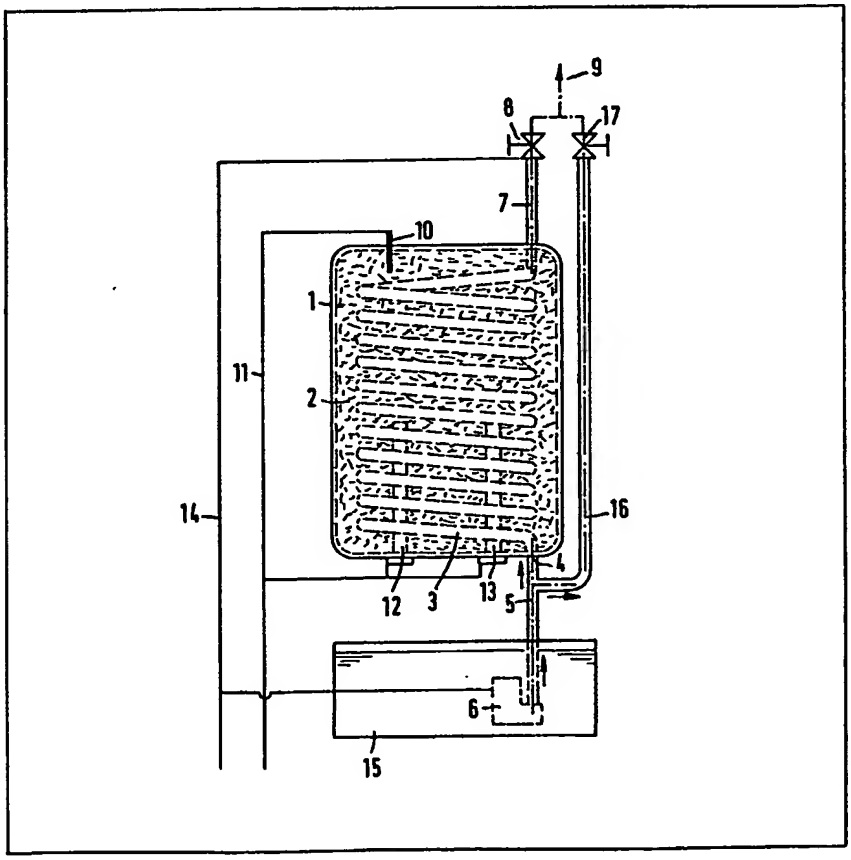
(71) Applicants
Siegas-Metallwarenfabrik Wilhelm Loh GmbH & Co. KG, Welterstrasse 55—57, 5900 Siegen 1, Germany, Fed. Rep. of Germany
(72) Inventor
Sven Torsten Stork
(74) Agents
Page, White & Farrer

(54) Water heaters for mobile installations

(57) A water heater for mobile installations such as caravans comprises a coil of pipe 3 mounted in a sealed container 1 filled with a frost-resistant heat carrier 2 which is constantly kept at a predetermined temperature by heating elements 12, 13. A hot water tap 8 controlling the outlet from the coil 3 is electrically connected to a feed pump 6 immersed in a water reservoir 15 so that when the tap is turned on water is fed through and heated by the pre-heated coil 3. When the tap 8 is turned off, the pump 6 is switched off first so that air enters the coil 3 and allows the water to drain back into the reservoir 15.



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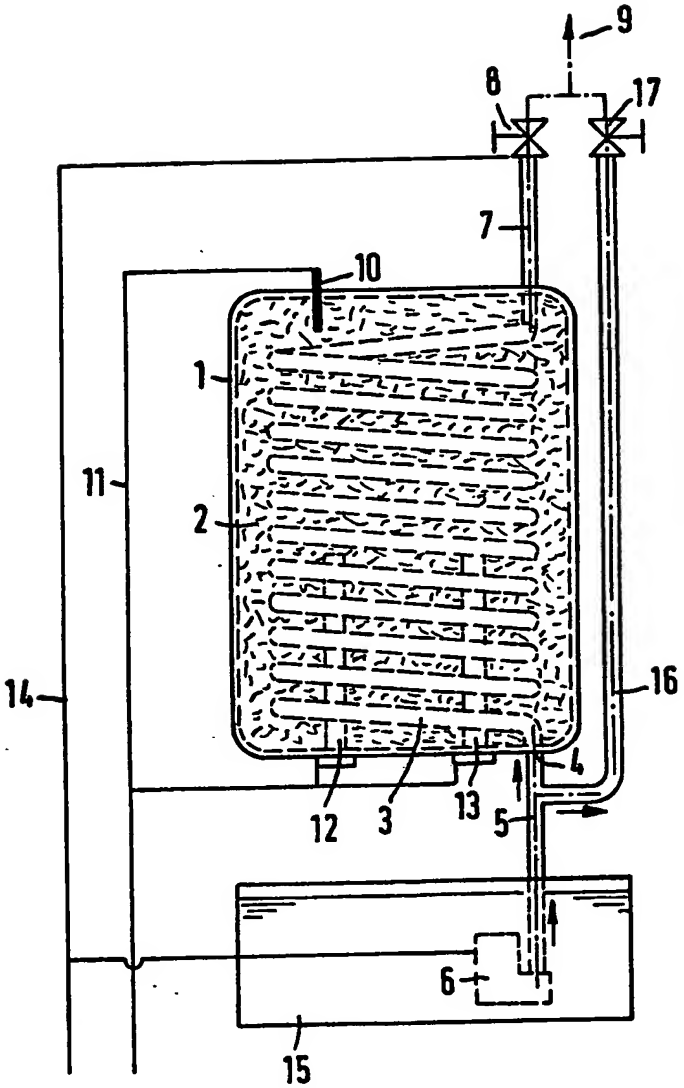

SPECIFICATION

Water heaters for mobile installations

The invention relates to water heaters for mobile installations, more particularly for caravans or the like, with a coil of pipe through which water flows, a feed pump for conveying hot and cold water separately from a common container, said feed pump being connected to the coil of pipe *via* conduits, and a connecting conduit between the coil of pipe and a water tap.

Known water heaters operate basically according to two different operating principles. In so-called hot water boilers, electric heating coils, heating cartridges or the like are arranged in a container of a specified volume. The container is constantly full of hot water and the heating members are connected to the mains, *via* suitable switching circuits with thermostats, so that when the water temperature falls below a prescribed, *e.g.* pre-set value, the heating means are switched on until the water has again been heated to a maximum temperature. Apparatus of this kind have the advantage that a given quantity of hot water is constantly available the moment the water tap is turned on. However, a disadvantage of these apparatus is that the temperature falls sharply from its original level of about 80°C, for example, even when relatively small amounts are drawn off. This is due to the fact that, in apparatus connected to a pressurised water supply network, cold water flows into the container as the tap is turned on. The quantity of hot water still contained in the container is mixed with the cold water flowing in, and this naturally leads to a drop in temperature. As soon as water is drawn off from this mixture, virtually cold water flows in. When hot water boilers of this kind are used in mobile installations such as caravans, trailers and the like, where there is no pressurised water available passing through fixed pipes, the task of the pressure valve is taken over by a feed pump which pumps the cold water out of a suitable reservoir in accordance with a specific switching pulse. Another disadvantage of this type of apparatus which is fundamental in practice is the risk of freezing. Caravans are often parked for long periods on specific sites to be used as holiday homes and are inhabited only at weekends. Therefore, to prevent damage to the boiler and pipe system if there is a sudden frost, the boiler together with the pipe system and the pump have to be emptied by means of special valves or the like before the caravan is left unattended. This emptying of the water heater is relatively often forgotten with the result that freezing and possible damage to the apparatus occur if the temperature falls accordingly.

The other basic operating principle mentioned hereinbefore is used in so-called water passage heaters, and consists in the fact that water-carrying coils of pipes are heated from outside by the hot combustion gases of a gas or heating-oil flame. The water is conveyed through the system of coils of pipes by means of a pump, for example, when the outlet tap is opened and is thereby heated. However, a certain warm-up time elapses before the maximum water temperature is reached, and this may be a disadvantage when rinsing a few items of crockery, for example. Known appliances of this kind for mobile installations are primarily intended to be heated by gas, since heating occurs only while the water is flowing through, but relatively high heating power is required during this period. Electricity supplies on camp sites are, however, frequently too low-powered and cannot supply the high currents required, particularly in surges. Moreover, since the coils of pipes have to be constantly full of water, in this type of appliance, so as to prevent overheating of the pipes when starting up, there is the danger of freezing and premature destruction of the coils of pipes.

The aim of the invention is to provide a water heater for mobile installations, particularly for caravans, trailers, holiday homes, builders' huts or the like, of the kind described hereinbefore, wherein larger quantities of hot water are available at all times even when the dimensions and capacity are relatively small.

According to the invention, there is provided a water heater for mobile installations, more particularly for caravans, trailers or the like, comprising a coil of pipe through which water flows and which is heated from outside, a feed pump connected to the coil of pipe *via* conduits, and a connecting duct to the water tap for the hot water, wherein the coil of pipe is mounted in a sealed container filled with a heat carrier and heating means are provided for constantly keeping the heat carrier at a predetermined temperature.

The water heater according to the invention has the advantage of using little power, so that it can also be connected, for example, to a low-powered electrical supply of the kind frequently found on camp sites. It has been found that, when operated in a state of readiness, *i.e.* with no water drawn off, a heating period of about 30 seconds per hour for a 5 litre heater was sufficient to keep the heat carrier in the container at a predetermined level. The drawing-off power was 800 Watts.

This solution has a number of advantages over the two types of apparatus described hereinbefore. For example, electrical heating of relatively low power, *e.g.* some 100 Watts, can be used and can be placed at the most suitable positions for heating in the container filled with the heat carrier. The temperature of the heat carrier is preferably monitored by a thermostat which switches on the electric heating when a lower temperature value is reached. Preferably, when the water tap is turned on, a pump is switched on which feeds cold water into the pipe system, which is kept at a specific temperature level. Since the heat carrier maintains the system of coiled pipes at a predetermined temperature level by means of the heating, the inflowing water is heated to this temperature. Another advantage of the water heater according to the invention is that, whilst comparatively little energy is used,

quantities of hot water are obtained which are substantially greater than the volume of the container used. Admittedly after some time there is a drop in the temperature of the hot water — because of the quantities of heat energy taken from the heat carrier — but this occurs gradually, since, if a suitable heat carrying medium is chosen, this medium also performs a considerable storing function.

Substances which have proved particularly favourable as the heat carrying medium are frost-resistant, non-toxic liquids with high heat absorption capacity and heat conductivity, which may contain calcium chloride and sodium nitrite, for example. However, fine-particled loose material, such as, for example, sand, finely ground ceramic materials, metal chippings or the like may also be used, and these materials should also have high heat-absorption capacities and good heat conductivity.

In another preferred feature of the invention, the system of coiled pipes is automatically emptied when the feed pump is stationary, and this can be achieved, for example, by a suitable construction of the feed pump with a reflux means, or by bypass conduits with valves or the like. These measures eliminate the dangers of freezing which occur with known water heaters of the kinds referred to above.

Depending on the shape of the container and the nature of the heat carrier used, so-called heating cartridges or heating wires can be arranged in a suitable manner in the container and used as the electric heating means.

A specific embodiment of the invention will now be described in detail with reference to the accompanying drawing, which is a diagrammatic vertical section through a water heater according to the invention.

The water heater shown comprises a container 1 almost totally filled with a liquid heat carrier 2 consisting of a mixture of calcium chloride, sodium nitrite and water. Also inside the container there extends a pipe 3 in the form of a coil, which is connected *via* a connecting member 4 to the feed conduit 5 of a pump 6 immersed in a storage container or reservoir 15. The pipe 3 passes out of the container 1 at the top and *via* a duct portion 7 and a water tap 8 to the outlet pipe 9. The temperature of the heat carrier 2 in the container is monitored by a thermostat 10 which is connected, *via* electric lines 11 and switches (not shown), to two heating cartridges 12, 13 which are mounted from outside, as sealed assemblies, on the lower wall of the container — or at another suitable point — and whose effective heating portions extend into the inside of the container.

Integrated in the manually actuatable water tap 8 there is an electric switch which switches on the feed pump 6 by means of an electric switching circuit 14 at the start of an opening turn of the tap, and switches it off shortly before the tap is fully turned off. This premature switching off of the pump shortly before the tap 8 is completely turned off allows air into the coiled pipes 3, 4, 7, so that the water contained in the coil of pipes can flow back into the storage container 15 immediately after the pump has stopped.

A cold water pipe 16 to which a separate water tap 17 is also connected is connected to the feed conduit 5 of the pump 6. Appropriately, this water tap 17 also contains an electric switch for switching the feed pump 6 on and off.

The container 1 diagrammatically shown in the drawing is obviously completely surrounded by a heat insulating material, so as to avoid heat loss as much as possible. Particularly low radiation of heat is obtained if the container has the smallest possible surface area, *i.e.* if the container is spherical in shape.

The hot water storage means described operates as follows:

By means of the switching on and off of the cartridges 12, 13 controlled by the thermostat 10, the heat carrier liquid inside the container 1 is maintained within a given temperature range of between 83 and 95°C, for example. When the hot water tap 8 is turned on, the feed pump 6 is switched on, for example after a predetermined initial turn, and forces cold water out of the storage container 15 through the feed conduit 5 and into the coils of pipe 3. The length and arrangement of this system of coiled pipe is such that the ascending water is heated to a temperature of, for example, 80°C as it emerges into the pipe 7. The hot water leaves the outlet 9 at this temperature. Because of the comparatively great storage capacity of the heat exchange medium, the latter releases its stored heat to the water flowing through the coil of pipes 3 over a relatively long period of time, so that the quantities of hot water drawn off may be substantially greater than the internal volume of the container 1. After a certain quantity of water has been drawn off, there is a gradual reduction in the temperature of the hot water running out, which is due to the decreasing heat content of the heat carrying medium.

When the hot water tap 8 is turned off, its integrated switch turns the feed pump off shortly before the tap is fully off. The water tap 8, which is still very slightly open, then forms a vent for the coil of pipe, from which the water can then automatically flow back into the storage container 15 through the feed conduit 5. In this way, it is ensured that the coil of pipe is emptied immediately after hot water has been drawn off, so that there is no risk of freezing after the energy supply has been switched off completely. Since the heat carrying liquid in the container 1 is frost-resistant, there is no danger of it freezing either.

CLAIMS

1. A water heater for mobile installations, more particularly for caravans, trailers or the like, comprising a coil of pipe through which water flows and which is heated from outside, a feed pump connected to the coil of pipe *via* conduits, and a connecting duct to the water tap for the hot water, wherein the coil of pipe is mounted in a

sealed container filled with a heat carrier and heating means are provided for constantly keeping the heat carrier at a predetermined temperature.

2. A water heater according to claim 1, wherein the heat carrier is a frost-resistant, non-toxic liquid which simultaneously has a high heat-absorption capacity and a high heat conductivity.

3. A water heater according to claim 2, wherein the heat carrier contains calcium chloride and sodium nitrite in water.

4. A water heater according to claim 1, wherein the heat carrier consists of loose material.

5. A water heater according to any one of the preceding claims, wherein means are provided for ensuring that the coil of pipe is emptied when the pump is stationary.

6. A water heater according to any one of the preceding claims, wherein the heating means comprise at least one electric heating cartridge mounted in the container.

7. A water heater according to any one of the preceding claims, wherein an electric switch which switches the pump on and off when the water tap is turned on and off is integrated in each of the cold and hot water taps.

8. A water heater according to any one of the preceding claims, wherein the container which contains the heat carrier, the coil of pipe and the heating means is heat-insulated and comprises a thermostat which monitors the temperature of the heat carrier.

9. A water heater for mobile installations, substantially as hereinbefore described and as illustrated in the accompanying drawing.

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